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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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09/891,727

06/26/2001

Daniel M. Kinzer

IR-1698 (2-2027)

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11/18/2003

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EXAMINER

LEWIS, MONICA

ART UNIT

PAPER NUMBER

2822

DATE MAILED: 11/18/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

09/891,727

Applicant(s)

KINZER ET AL.

Examiner

Monica Lewis

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 04 September 2003.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-28 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-28 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 09 January 2002 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. §§ 119 and 120**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.  
a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

**Attachment(s)**

- 1) ☐ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_ 6) ☐ Other: \_\_\_\_\_

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### **DETAILED ACTION**

1. This office action is in response to the appeal brief filed September 4, 2003.

#### ***Response to Amendment***

2. Applicant's request for reconsideration of the finality of the rejection of the last Office action is persuasive and, therefore, the finality of that action is withdrawn.

#### ***Response to Arguments***

3. Applicant's arguments with respect to claims 1-28 have been considered but are moot in view of the new ground(s) of rejection.

#### ***Information Disclosure Statement***

4. The listing of references in the specification is not a proper information disclosure statement. 37 CFR 1.98(b) requires a list of all patents, publications, or other information submitted for consideration by the Office, and MPEP § 609 A(1) states, "the list may not be incorporated into the specification but must be submitted in a separate paper." Therefore, unless the references have been cited by the examiner on form PTO-892, they have not been considered.

#### ***Claim Rejections - 35 USC § 102***

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

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6. Claims 1-3 are rejected under 35 U.S.C. 102(b) as being anticipated by Kitamura et al. (U.S. Patent No. 5,844,275).

In regards to claim 1, Kitamura et al. ("Kitamura") discloses the following:

a) trench receiving layer (2) of said one of the conductivity types supported atop said substrate and having an upper surface (For Example: See Figure 1);

b) a plurality of spaced laterally extending trenches formed into said trench-receiving layer (For Example: See Figure 9);

c) a diffusion of the other of said conductivity types extending into the walls of said trenches (3) and having a given depth and a given concentration (For Example: See Figure 1);

d) trenches defining mesas between them of a given width and a given concentration (For Example: See Figure 9);

e) a drain region (11) of said other of said conductivity types extending into, said trench receiving layer and disposed at the end of said mesas (For Example: See Figure 1);

f) a MOSgate structure including a source region (9), base region (8) and a gate electrode (7) disposed at the other end of said mesas (For Example: See Figure 1); and

g) mesas extends between said drain region and said MOSgate structure (For Example: See Figure 9).

In regards to claim 1, Kitamura fails to disclose the following:

a) the thickness and concentration of said mesas and said diffusions being selected to cause each to fully deplete under blocking voltage conditions.

Although, Kitamura does not specifically disclose that the thickness and concentration of said mesas and said diffusions being selected to cause each to fully deplete under blocking voltage conditions, it is inherent to the structure itself.

In regards to claim 2, Kitamura discloses the following:

a) a dielectric filler (5) in each of said trenches (For Example: See Figure 1).

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In regards to claim 3, Kitamura discloses the following:

a) source, drain and gate contacts (14, 7 and 15) supported on said upper surface and connected to said source region, gate electrode and drain regions respectively (For Example: See Figure 1).

***Claim Rejections - 35 USC § 103***

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 4, 6 and 15-21 are rejected under 35 U.S.C. 103(a) as obvious over Kitamura et al. (U.S. Patent No. 5,844,275) in view of Ranjan (U.S. Patent No. 5,861,657).

In regards to claim 4, Kitamura discloses the following:

a) substrate is a lightly doped P type material (For Example: See Figure 1).

In regards to claim 4, Kitamura fails to disclose the following:

a) RESURF concentrations.

However, Ranjan discloses a semiconductor device where there is RESURF (For Example: See Column 1 Lines 17-20 and Column 2 Lines 7-16). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Kitamura to include mesas and diffusions that have RESURF as disclosed in Ranjan because it aids in controlling the breakdown voltage (For Example: See Column 1 Lines 17-20 and Column 2 Lines 7-16).

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Additionally, since Kitamura and Ranjan are both from the same field of endeavor, the purpose disclosed by Ranjan would have been recognized in the pertinent art of Kitamura.

In regards to claim 6, Kitamura fails to disclose the following:

a) diffusion extending into said further region along the bottoms of said trenches.

However, Ranjan discloses a semiconductor device where the diffusion extends (For Example: See Column 2 Lines 7-16). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Kitamura to include diffusion that extends as disclosed in Ranjan because it aids in the formation of isolated regions (For Example: See Column 2 Lines 7-16).

Additionally, since Kitamura and Ranjan are both from the same field of endeavor, the purpose disclosed by Ranjan would have been recognized in the pertinent art of Kitamura.

In regards to claim 15, Kitamura discloses the following:

a) a dielectric filler in each of said trenches (For Example: See Figure 1).

In regards to claims 16 and 18, Kitamura discloses the following:

a) source, drain and gate contacts supported on said upper surface and connected to said source region, gate electrode and drain regions respectively (For Example: See Figure 1).

In regards to claims 17 and 19-21, Kitamura discloses the following:

a) substrate is a lightly doped P type material (For Example: See Figure 1).

In regards to claims 17 and 19-21, Kitamura fails to disclose the following:

a) RESURF concentrations.

However, Ranjan discloses a semiconductor device where there is RESURF (For Example: See Column 1 Lines 17-20 and Column 2 Lines 7-16). It would have been obvious to

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one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Kitamura to include mesas and diffusions that have RESURF as disclosed in Ranjan because it aids in controlling the breakdown voltage (For Example: See Column 1 Lines 17-20 and Column 2 Lines 7-16).

Additionally, since Kitamura and Ranjan are both from the same field of endeavor, the purpose disclosed by Ranjan would have been recognized in the pertinent art of Kitamura.

9. Claims 5 and 8-14 are rejected under 35 U.S.C. 103(a) as obvious over Kitamura et al. (U.S. Patent No. 5,844,275) in view of Sakakibara et al. (U.S. Patent No. 5,449,946) and Ranjan (U.S. Patent No. 5,861,657).

In regards to claim 5, Kitamura fails to disclose the following:

a) a further region of said other conductivity interposed between said substrate and said trench receiving layer being more lightly doped than said diffusion.

However, Sakakibara discloses a further region (2a) of said other conductivity interposed between said substrate and said trench receiving layer (For Example: See Figure 1). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Kitamura to include a further region as disclosed in Sakakibara because it aids in preventing capacitive coupling (For Example: See Column 1 Lines 40-68 and Column 2 Lines 1 and 2).

Additionally, since Kitamura and Sakakibara are both from the same field of endeavor, the purpose disclosed by Sakakibara would have been recognized in the pertinent art of Kitamura.

b) diffusion extending into said further region along the bottoms of said trenches.

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However, Ranjan discloses a semiconductor device where the diffusion (23) extends (For Example: See Column 2 Lines 7-16). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Kitamura to include diffusion that extends as disclosed in Ranjan because it aids in the formation of isolated regions (For Example: See Column 2 Lines 7-10).

Additionally, since Kitamura and Ranjan are both from the same field of endeavor, the purpose disclosed by Ranjan would have been recognized in the pertinent art of Kitamura.

In regards to claim 8, Kitamura discloses the following:

- a) a dielectric filler in each of said trenches (For Example: See Figure 1).

In regards to claims 9 and 11, Kitamura discloses the following:

- a) source, drain and gate contacts supported on said upper surface and connected to said source region, gate electrode and drain regions respectively (For Example: See Figure 1).

In regards to claims 10 and 12-14, Kitamura discloses the following:

- a) substrate is a lightly doped P type material (For Example: See Figure 1).

In regards to claims 10 and 12-14, Kitamura fails to disclose the following:

- a) RESURF concentrations.

However, Ranjan discloses a semiconductor device where there is RESURF (For Example: See Column 1 Lines 17-20 and Column 2 Lines 7-16). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Kitamura to include mesas and diffusions that have RESURF as disclosed in Ranjan because it aids in controlling the breakdown voltage (For Example: See Column 1 Lines 17-20 and Column 2 Lines 7-16).



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Additionally, since Kitamura and Ranjan are both from the same field of endeavor, the purpose disclosed by Ranjan would have been recognized in the pertinent art of Kitamura.

10. Claims 7 and 22-28 are rejected under 35 U.S.C. 103(a) as obvious over Kitamura et al. (U.S. Patent No. 5,844,275) in view of Malhi (U.S. Patent No. 5,539,238).

In regards to claim 7, Kitamura fails to disclose the following:

a) insulation layer interposed between said substrate and said trench receiving layer the upper surface of said insulation layer being coplanar with the bottoms of said trenches.

However, Malhi discloses an insulating layer (For Example: See Column 3 Lines 13-18). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Kitamura to include an insulating layer as disclosed in Malhi because it aids in keeping the devices from shortening out (For Example: See Figure 2).

Additionally, since Kitamura and Malhi are both from the same field of endeavor, the purpose disclosed by Malhi would have been recognized in the pertinent art of Kitamura.

In regards to claim 22, Kitamura discloses the following:

a) a dielectric filler in each of said trenches (For Example: See Figure 1).

In regards to claims 23 and 25, Kitamura discloses the following:

a) source, drain and gate contacts supported on said upper surface and connected to said source region, gate electrode and drain regions respectively (For Example: See Figure 1).

In regards to claims 24 and 26-28 Kitamura discloses the following:

a) substrate is a lightly doped P type material (For Example: See Figure 1).

In regards to claims 24 and 26-28 Kitamura fails to disclose the following:

a) RESURF concentrations.

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However, Ranjan discloses a semiconductor device where there is RESURF (For Example: See Column 1 Lines 17-20 and Column 2 Lines 7-16). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Kitamura to include mesas and diffusions that have RESURF as disclosed in Ranjan because it aids in controlling the breakdown voltage (For Example: See Column 1 Lines 17-20 and Column 2 Lines 7-16).

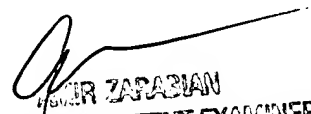
Additionally, since Kitamura and Ranjan are both from the same field of endeavor, the purpose disclosed by Ranjan would have been recognized in the pertinent art of Kitamura.

***Conclusion***

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Monica Lewis whose telephone number is 703-305-3743. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on 703-308-4905. The fax phone number for the organization where this application or proceeding is assigned is 703-308-7722 for regular and after final communications. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

ML

November 17, 2003

  
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